ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF COMMERCIAL FISHERIES

1990 AND 1991 SOUTHERN DISTRICT (KACHEMAK BAY) DUNGENESS CRAB POT SURVEYS INCLUDING COMPARISON TO TRAWL SURVEY CATCH

by Al Kimker

Regional Information Report No. 2H91-05[1]

Alaska Department of Fish and Game
Division of Commercial Fisheries
333 Raspberry Road
Anchorage, Alaska 99518-1599

Carl L. Rosier - Commissioner
Denby Lloyd - Director of Commercial Fisheries

December 1991

[1] Contribution 91-05 from the Homer area office. The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data; this informational may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICIES

INTRODUCTION

In 1990 the department began a pot survey for Dungeness crabs (Cancer magister) in Kachemak Bay, which is a part of the Southern District of the Cook Inlet Management Area (Figure 1). Initially the survey was intended to document both the molt timing of catchable Dungeness crabs in upper Kachemak Bay only and open the fishery once the majority of the molt was complete, which would be signified by a male softshell percentage below 10. Catches in 1990 however averaged less than one legal male per pot. Once the commercial season opened, fishery performance indicated that the number of legal male Dungeness was at a historical low. It appeared, therefore, that the poor catches recorded by the 1990 survey were indicative of stock abundance. The 1991 survey was therefore expanded to collect data for both molt timing and establishment of an index of relative abundance. Since the fishery collapsed west of Homer Spit as well as in upper Kachemak Bay, the survey was expanded to the west in order to provide information on the Dungeness crab stock in the entire bay. A summary of the current objectives is as follows:

1) Identify the annual timing of the molt, or molts, of catchable Dungeness crabs, both male and female.

2) Document the percentage of soft shell male Dungeness crabs.

3) Document the sex, size and shellage of all Dungeness crabs and the egg condition of all female Dungeness crabs.

4) Establish an index of abundance of Dungeness crabs.

5) Document the incidental catch of king and Tanner crabs.

The crab trawl surveys in Cook Inlet began in 1989, but were not fully implemented until 1990. The primary goal of the trawl survey was to assess Tanner (Chionoecetes bairdi) and red king crab (Paralithodes camtschaticus) stocks. Ancillary information, such as Dungeness catch, was documented. The initial survey design did not focus on Dungeness, since during likely survey months, June - August (post Tanner and king molt), a portion of the stock would not be available to the gear, i.e., they were in waters too shallow to sample with a trawl. These Dungeness data will be presented in this report to allow comparison to the pot survey catches.

METHODS

In both 1990 and 1991 the State chartered the F\V Lion of Judah for the entire survey. Standard Dungeness pots of two distinct weights were used for the survey: pots used east and west of Homer Spit were 60 and 100 pounds, respectively. The gear dimensions reflected those generally used by commercial fishermen. Escape rings were left open in order to indicate catches of commercial fishermen. Bait types used were squid and razor clams, east and west of Homer Spit, respectively. These bait types also reflect those commonly used by commercial fishermen. Initial soak time goals were 24 hours east of the Spit and 48 hours west of the Spit. The variation in soak times was the result of both fishermen comments regarding the time necessary for the pots to begin fishing and cost of the charter.

Selection of survey stations was systematic. Commercial fishermen were interviewed in order to determine specific locations for crab capture given the time of year the survey was to occur. A total of 180 stations were selected, 90 east (Appendix A) and 100 west of Homer Spit (Appendix B). Timing of the respective surveys within the year was based on fishermen input, historical catch figures, and suspected and known molt timing of catchable males.

The gear was set east of Homer Spit in three 15 pot strings in the Mud Bay area and 15 three pot springs in the upper bay (Figure 2a). Ten 10 pot strings were fished west of Homer Spit (Figure 2b). Distance between individual pots within a string was approximately 0.25 nautical miles east of Homer Spit and 0.20 nautical miles west of the Spit.

A Loran C, video plotter and echo sounder were used to record pot and station information for future reference and replication. Depths were recorded at the time the gear was set utilizing the vessel's sounder. Documented depths do not take into consideration the stage of the tide.

Speed was often essential while pulling the pots. Shallow sets coupled with running tides and currents made it necessary to move through the gear with maximum efficiency in order to retrieve all the pots before the water became too shallow for the vessel or the current pulled the buoys under. In some instances therefore, the bycatch species were not sampled.

Once each pot was pulled, all Dungeness, king and male Tanner crabs were measured to the nearest millimeter (mm) of carapace width (Dungeness and Tanner) or length (king) and shell aged. Relative fecundity of all Dungeness and king crab females was determined. Juvenile female Dungeness were not identified since positive classification would have required destroying the animal. Female Tanners were counted only.

RESULTS

1990 Survey

In 1990 test fishing was conducted east of Homer Spit only. The first survey was from May 15 - 17 and the second from June 19 - 21.

A total of 180 pots were pulled, 90 in each of the two surveys. No gear was lost. Fishing depths ranged from 1.5 to 9.5 fathoms with an average 4.0 fathoms. Soak times averaged 23 hours (Table 1).

A total of 64 male and 53 female Dungeness were captured during the May survey. Forty seven of the males were sublegal and 17 were legal. Eight (13 %) of the males were soft shelled (Table 2). Fifty eight percent of the males were new shell and 42 percent were skipmolts (Table 3). The size range of the males was 101 to 190 mm with a mean of 155 mm (Figure 3). Of the 53 females caught only three were ovigerous; all three clutches were eyed (Table 4).

In June, 88 males and 54 females were captured. Sublegals and legals numbered 65 and 23, respectively. Nine (10 %) of the males where soft shelled (Table 2). Seventy eight percent of all the males were new shell while 22 percent were skipmolts (Table 3). The size range of the males was 102 to 189 mm with an average of 154 mm (Figure 4). None of the 54 females caught were ovigerous (Table 4).

The Tanner crab catch was one male and no females in the May survey and no males and one female in the June survey. No king crabs were captured in either month (Table 5).

1991 Survey

The 1991 test fishing was conducted both east and west of Homer Spit. The range of dates for the four surveys east of Homer Spit were: June 4 - 6, July 9 - 11, August 6 - 8 and September 12 - 14. Ninety pot lifts occurred in each survey east of the Spit except in June when one pot was lost resulting in 89 pot lifts. Fishing depths ranged from 1.0 to 10.0 fathoms (Table 1).

The two surveys west of the Spit were July 2 - 6 and August 14 - 16. Eighty two and 95 pots were pulled west of the Spit in July

and August, respectively. Eighteen pots were lost in July and five in August. The majority of the gear lost in July was recovered during the August survey. Fishing depth ranged from 13.0 to 45.0 fathoms (Table 1).

East of Homer Spit (1991)

The Dungeness catch in the June, 1991 survey was 226 males and 6 females. Sublegal and legal males numbered 116 and 110, respectively. Twenty one (9 %) of the males were in a soft shell condition (Table 2). Ninety two percent of the legal males were new shells - the remaining eight percent were skipmolts (Table 3). The size range of the males was 135 to 187 mm with an average of 164 mm. All the legals were in the recruit size range (165 - 189 mm) (Figure 5). None of the six females caught were ovigerous (Table 4).

The July survey resulted in a catch of 651 males and 21 females. Three hundred eighty eight males were sublegal, while the remaining 263 were legal. Thirty six (6 %) of the males were soft shelled (Table 2). In excess of 99 percent of the legal males were new shells while 95 percent of the sublegals were new (Table 3). The males ranged in size from 114 to 182 mm, averaging 163 mm. All legal males were in the recruit size range (Figure 6). Of the 21 females captured, two were bearing full clutches of uneyed eggs while the remaining 19 were non-ovigerous (Table 4).

The August survey produced a catch 1100 males and 85 females. Sublegal males numbered 625 while legals accounted for 475 crabs. Forty seven (4 %) of the males were in a soft shell condition (Table 2). New shell recruits accounted for 99 percent of the legal males. Ninety seven percent of all sublegals were new shells (Table 3). The size range of all the males caught was 129 - 185 mm with an average of 164 mm (Figure 7). None of the 85 females captured were ovigerous (Table 4).

The final survey, which was conducted in September, yielded a catch of 1107 males, 615 sublegal and 492 legal, as well as 30 females. Five (< 1 %) of the males were in a soft shell condition (Table 2). Ninety nine percent of the legal male catch consisted of new shell recruits, while 97 percent of all the sublegals were new shells (Table 3). The males varied in size from 127 to 189 mm, averaging 164 mm (Figure 8). None of the 30 females caught were ovigerous (Table 4).

The male and female Tanner crab catch numbered 101 and 14, respectively, for the June survey. Eight, thirteen and two males were captured in the successive July, August and September surveys. No females were found after June. Two male and two female king crabs were caught in June, but none thereafter (Table 5).

West of Homer Spit (1991)

The July 1991 survey west of Homer Spit resulted in a catch of 11 males and nine females. Five of the males were legal. Two (18 %) of the 11 total males were in a soft shell condition (Table 2). The males ranged in size from 158 to 174 mm with an average of 164 millimeters. None of the nine females were ovigerous (Table 4).

The survey conducted in August produced a catch of 18 males, 11 legals and seven sublegals, as well as nine females. None of the males were soft shelled (Table 2). The size range of the males was 158 - 197 mm, averaging 172 mm. Of the nine females, none were ovigerous (Table 4).

Seventy six male and 31 female Tanner crabs were found in the July survey. Thirty three and 29, males and females, respectively, were caught in August. No king crabs of either sex were captured (Table 5).

1989 - 1991 trawl survey

Male Dungeness catches from the 1989 - 1991 trawl survey were 304, 317 and 234 crabs, respectively. Mean carapace widths for these successive years were 118, 134 and 155 mm (Figs. 9 - 11). Females numbered 630, 660 and 476 crabs for 1989 through 1991. Average carapace widths were 124, 129 and 134 mm (Figs. 12 - 14). Fewer stations were fished in 1989, 11, than in 1990 and 1991 when 19 and 20, respectively, were trawled (Table 6).

DISCUSSION

In 1990 both pot and trawl surveys identified poor recruitment into the legal segment of the stock. The extremely low catches of legal crabs in the 1990 pot survey indicated a very low abundance of legal males. This was reflected in the ensuing commercial fishery where a 23 year record low harvest of 29,000 pounds was taken (Table 7).

Further review of the pot and trawl survey data collected from east of Homer Spit indicates the presence of one or perhaps two Dungeness year classes of substantial magnitude. Both completely recruited into the adult population subsequent to the 1991 molt. Full recruitment into the legal segment of the stock will occur after the 1992 molt.

No other year classes appear in the data. The catchability of smaller crabs by pots may explain the absence of younger year classes in the pot survey. The trawl surveys, however, indicated a year class advancing toward maturity and eventually recruiting into the fishery. The small crabs were first captured in the 1989 survey. Complete recruitment into the adult segment of the stock and partial recruitment into the legal segment was identified by the 1991 survey (Figure 15).

The 1989 data indicate that the trawl is capable of catching small crabs (75 mm or larger). It, therefore, seems logical to question whether or not the absence of a smaller, younger year classes in either the 1990 or 1991 trawl survey is an indication of potentially poor recruitment into the legal segment of the stock in 1993 and 1994? A clear answer is not evident. There is circumstantial evidence leading to uncertainty regarding juvenile Dungeness aggregation. Distribution of these small, juvenile Dungeness may preclude them from trawl capture at any given time. There is no survey evidence demonstrating the exclusive location of juvenile Dungeness crabs in Kachemak Bay. Personal communication with sport and commercial fishermen indicates that apparent substantial numbers of juvenile crabs reside both in upper Cook Inlet and embayments that are largely intertidal (China Poot). Areas such as this are not trawlable.

The pot survey did not identify a large percentage of soft shell males in either 1990 or 1991. The largest percentages were 13 in 1990 and nine in 1991 (Table 2). In 1990 this in part can be explained by the few available males large enough to be caught and retained in the pot survey. In 1991 however, when more adult and legal crabs were available for capture by the pots, the softshell percentage in the pot survey for all males reached its high in June at nine percent. Based on the trawl survey results, it appears that for 1991 at least, a greater percentage of softshells existed in the deeper waters (> 15 fathoms) sampled by the trawl. The July trawl survey resulted in 20 percent total male soft shells. Interestingly the female softshell percentage from the July, 1991 trawl survey was zero (Table 8).

Molt timing in 1990 can be pieced together by relating the May and June pot and July trawl surveys to an additional crab sample taken in August. The male soft shell percentage from the 1990 pot survey was 13 percent in May and 10 percent in June. The male soft shell percentage identified by the July, 1990 trawl survey was 12. The

data collected by the department in August 1990 indicates that a substantial portion of the molt for this year class (es) occurred in August. On August 20, 1990, molted Dungeness exoskeletons were found in large numbers within the Homer Boat Harbor. The condition of these shells indicated a very recent molt. Of the 100 male carapaces measured, the mean width was 123 mm with a range of 101 to 142 mm.

In 1991, however, with significantly larger pot catches, it appears that the molt occurred in late June through July. This is based on both the softshell catch from the trawl survey and the steady increase in the male catch from the June to the August pot survey 226 to 651 to 1,100 male crabs, respectively. The September pot catch was virtually identical to the August catch, although the soft shell percentage did diminish from four percent in August to less than one percent in September (Table 2). Reviewing the difference in size distribution and soft shell incidence from the 1991 data indicates that the Dungeness males may have molted in deep water, which was sampled by the trawl survey, and subsequently migrated to shallower water, which was sampled by the pot survey.

Initially the pot survey east of Homer Spit appears to be reflective of the legal male stock abundance as evidenced both by a record low commercial harvest in 1990, following a very low pot survey catch, and a relation to the trawl survey data, that is, a year class moving through the trawl surveys was identified by the pot survey when it became catchable in 1991.

Pot and trawl survey results west of Homer Spit did not indicate that any significant amount of catchable Dungeness crabs were available at the time of the surveys. It must be noted that the surveys occurred at the time of the historical commercial fisheries. Neither the pot nor the trawl survey are capable of sampling upper Cook Inlet where an unknown quantity of Dungeness crab may exist.

In summation, future comparisons to trawl surveys, commercial and sport fisheries are essential in building a database which can be utilized to judge the capability of the pot survey to assess relative abundance of legal male Dungeness crabs.

E.E.O. STATEMENT

The Alaska Department of Fish and Game operates all of its public programs and activities free from discrimination on the basis of race, religion, color, national origin, age, sex, or handicap. Because the department receives federal funding, any person who believes he or she has been discriminated against should write to:

O.E.O.
U.S. Department of Interior
Washington, DC 20240

Table 1. Station descriptive data, Kachemak Bay Dungeness crab survey, 1990-91.

Date[1]	Location	Station	No. Pots Pulled	Depth (fms)[2] Range	Depth (fms)[2] Average	Soak Avg. hrs.
5/15/90	East of Spit	Mud Bay	45	2.8 - 9.5	4.8	23
5/16/90		Upper Bay	45	1.8 - 8.8	4.1	23
		subtotal	90	1.8 - 9.5	4.4	23
6/19/90		Mud Bay	45	1.5 - 5.8	3.3	25
6/20/90		Upper Bay	45	2.8 - 5.3	3.7	22
		subtotal	90	1.5 - 5.8	3.5	23
1990	East of Spit	Total	180	1.5 - 9.5	4.0	23
6/4/91	East of Spit	Mud Bay	45	2.0 - 8.3	4.1	24
6/5/91		Upper Bay	44	2.3 - 10.0	4.4	24
		subtotal	89	2.0 - 10.0	4.3	24
7/9/91		Mud Bay	45	1.0 - 4.3	2.2	24
7/10/91		Upper Bay	45	2.2 - 8.8	4.3	23
		subtotal	90	1.0 - 8.8	3.2	24
8/6/91		Mud Bay	45	1.8 - 7.8	3.5	25
8/7/91		Upper Bay	45	2.7 - 8.3	4.2	23
		subtotal	90	1.8 - 8.3	3.8	24
9/12/91		Mud Bay	45	2.7 - 6.2	3.8	25
9/13/91		Upper Bay	45	1.7 - 6.8	3.2	22
		subtotal	90	1.7 - 6.8	3.5	23
1991	East of Spit	Total	359	1.0 - 10.0	3.7	24

Table 1. Continued.

Date[1]	Location	Station	No. Pots Pulled	Depth (fms)[2] Range	Depth (fms)[2] Average	Soak Avg. hrs.
7/2/91	West of Spit	91 - 100	82	13.0 - 42.0	25.6	69
8/14/91		91 - 100	95	16.0 - 45.0	27.6	50
1991		Total	177	13.0 - 45.0	26.8	59

[1] Date gear was set.

[2] Depths calculated from vessels sounder at time gear was set. Not calculated from mean lower low water as used on navigational charts.

Table 2. Dungeness crab catch, in numbers, Southern District Dungeness pot surveys, 1990-91.

Year	Dates	Location	Pots Pulled	Females	Sublegal Males(%)	Legal Males(%)	Total Males	Soft-shell Males(%)
1990	5/15-17	East of Spit	90	53	47 (73)	17 (27)	64	8 (13)
	6/19-21	East of Spit	90	54	65 (74)	23 (26)	88	9 (10)
1991	6/4-6	East of Spit	89	6	116 (51)	110 (49)	226	21 (9)
	7/9-11	East of Spit	90	21	388 (60)	263 (40)	651	36 (6)
	8/6-8	East of Spit	90	85	625 (57)	475 (43)	1,100	47 (4)
	9/12-14	East of Spit	90	30	615 (56)	492 (44)	1,107	5 (<1)
	7/2-6	West of Spit	82	9	6 (55)	5 (45)	11	2 (18)
	8/14-16	West of Spit	95	9	7 (39)	11 (61)	18	0 (0)

Table 3. Shell age of male Dungeness crabs from the Southern District Dungeness pot survey, 1990-91

Year	Dates	Location	Shell age: Number sublegals New[1] (%)	Old (%)	Total	Number legal New[1] (%)	Old (%)	Total	All Males New[1] (%)	Old (%)	Total
1990	5/15-17	East of Spit	30(64)	17(36)	47	7(41)	10(59)	17	37(58)	27(42)	64
	6/19-21	East of Spit	52(80)	13(20)	65	17(74)	6(26)	23	69(78)	19(22)	88
1991	6/4-6	East of Spit	89(77)	27(23)	116	101(92)	9(8)	110	190(84)	36(16)	226
	7/9-11	East of Spit	368(95)	20(5)	388	262(99)	1(1)	263	630(97)	21(3)	651
	8/6-8	East of Spit	607(97)	18(3)	625	470(99)	5(1)	475	1,077(98)	23(2)	1,100
	9/12-14	East of Spit	596(97)	19(3)	615	486(99)	6(1)	492	1,082(98)	25(2)	1,107
1991	7/2-6	West of Spit	2(33)	4(67)	6	4(80)	1(20)	5	6(55)	5(45)	11
	8/14-16	West of Spit	6(86)	1(14)	7	7(64)	4(36)	11	13(72)	5(28)	18

[1] Includes softshells.

Table 4. Female Dungeness crab catch, Southern District Dungeness pot surveys, 1990-91.

Year	Dates	Location	Total females	Number w/eggs	Number w/o eggs[1]	Avg. size (mm)	Size range	Number soft shells (%)
1990	5/15-17	East of Spit	53	3[2]	50	149	113 - 165	6 (13)
	6/19-21	East of Spit	54	0	54	153	106 - 171	8 (15)
	6/4-6	East of Spit	6	0	6	152	120 - 163	0
	7/9-11	East of Spit	21	2[3]	19	149	119 - 165	0
	8/6-8	East of Spit	85	0	85	150	116 - 173	0
	9/12-14	East of Spit	30	0	30	149	128 - 170	0
	7/2-6	West of Spit	9	0	9	155	135 - 163	0
	8/14-16	West of Spit	9	0	9	155	148 - 175	0

[1] Barren adults not distinguished from juveniles.

[2] Eyed.

[3] Uneyed.

Table 5. Tanner and king crab bycatch from the Southern District Dungeness crab pot survey, 1990-1991.

Year	Dates	Location	Tanner crabs		King crabs	
			males	females	males	females
1990	5/15/17	East of Spit	1	0	0	0
	6/19-21	East of Spit	0	1	0	0
1991	6/4-6	East of Spit	101	14	2	2
	7/9-11	East of Spit	8	0	0	0
	8/6-8	East of Spit	13	0	0	0
	9/12-14	East of Spit	2	0	0	0
1991	7/2-6	West of Spit	76	31	0	0
	8/14-16	West of Spit	33	29	0	0

Table 6. Summary of Dungeness crab catch, Southern District crab trawl survey, 1989-91.

Date	Stations	Total Dungeness catch (no.)	Males	Average width (mm)	Range	Females	Average width (mm)	Range
Oct., 1989	11	934	304	118	28 - 216	630	124	24 - 170
July, 1990	19	977	317	134	91 - 181	660	129	102 - 171
July, 1991	20	710	234	155	111 - 183	476	134	106 - 173

Table 7. Dungeness crab catch by year, Cook Inlet Management Area, 1961 - 1990.

Year	Southern district catch (lbs.)	Other districts catch (lbs.)	Total catch (lbs.)	No. of Vessels	No. of Landings
1961	193,683	0	193,683		
1962	530,770	0	530,770		
1963	1,665,599	11,605	1,677,204		
1964	417,005	6,036	423,041		
1965	74,211	0	74,211		
1966	12,523	117,037	129,560		
1967	7,168	0	7,168		
1968	484,452	3,407	487,859		
1969	49,894	0	49,894		
1970	209,819	0	209,819		
1971	97,161	0	97,161		
1972	38,930	0	38,930		
1973	308,777	1,271	310,048		
1974	718,729	2,514	721,243	38	619
1975	361,893	922	362,815	34	402
1976	118,903	395	119,298	19	123
1977	74,195	510	74,705	18	94
1978	1,212,571	3,208	1,215,779	49	668
1979	2,130,963	0	2,130,963	72	1,485
1980	1,875,281	0	1,875,281	54	1,183
1981	1,850,977	0	1,850,977	88	2,047
1982	818,380	505	818,885	108	2,310
1983	746,585	834	747,419	71	1,194
1984	799,638	570	800,208	102	1,687
1985	1,389,891	12,511	1,402,402	106	1,768
1986	550,968	12,894	563,862	83	1,069
1987	761,423	21,753	783,176	100	1,377
1988	677,334	41,941	719,275	84	1,305
1989	170,266	7,798	178,064	43	455
1990	28,938	564	29,502	23	112

Note: Average catch 1978-1990 = 1.01 million pounds per year.

Table 8. Incidence of soft shelled Dungeness crab, Southern District crab trawl survey, 1989-91.

Date	Total males	No. soft (%)	Legal males	No. soft (%)	Sublegal males	No. soft (%)	Females	No. soft(%)
Oct., 1989	304	33 (11)	23	1 (4)	281	32 (11)	630	48 (8)
July, 1990	317	37 (12)	6	0	311	37 (12)	660	72(11)
July, 1991	234	47 (20)	46	11 (24)	188	36 (19)	476	0

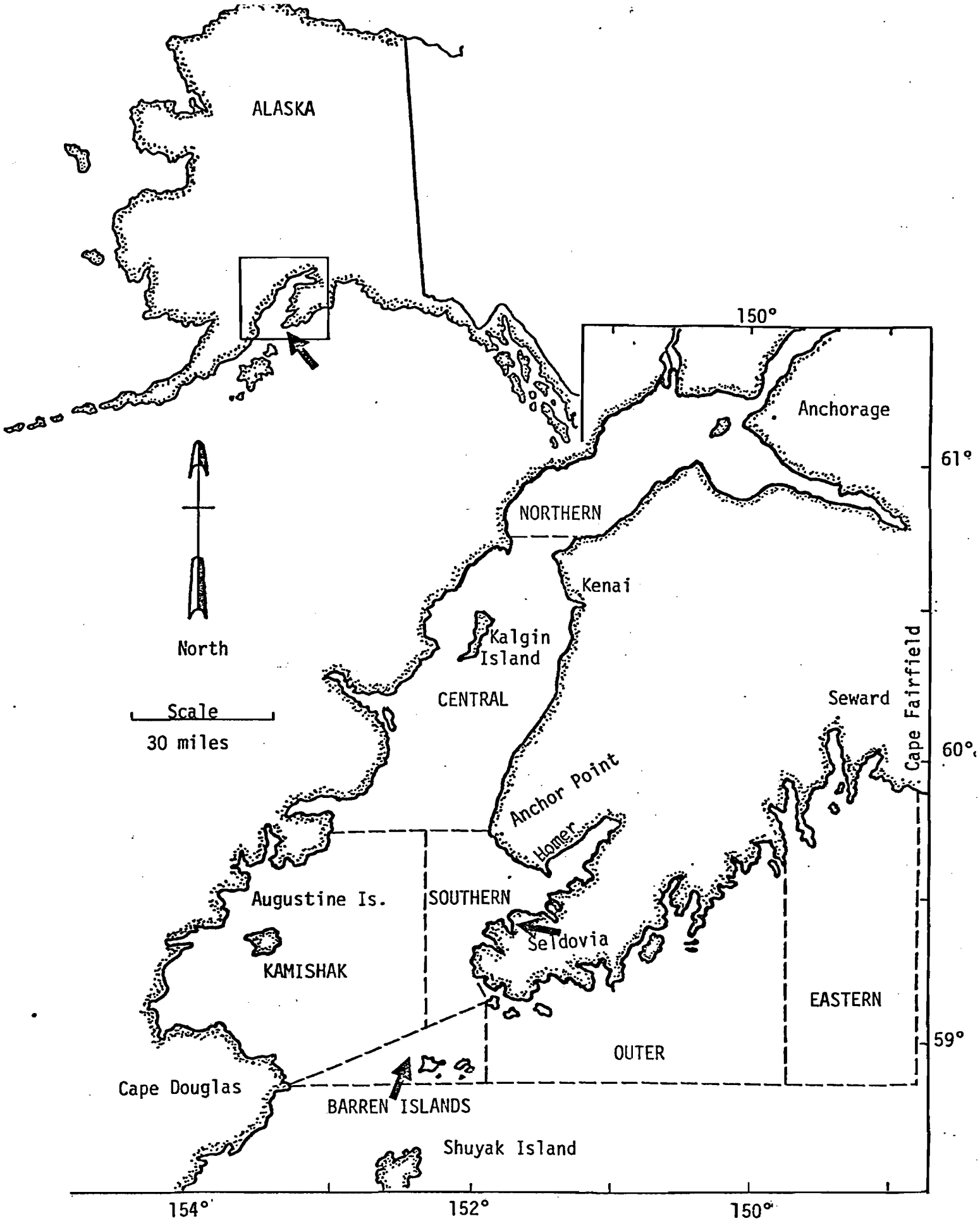

Figure 1 . Cook Inlet area district location chart.

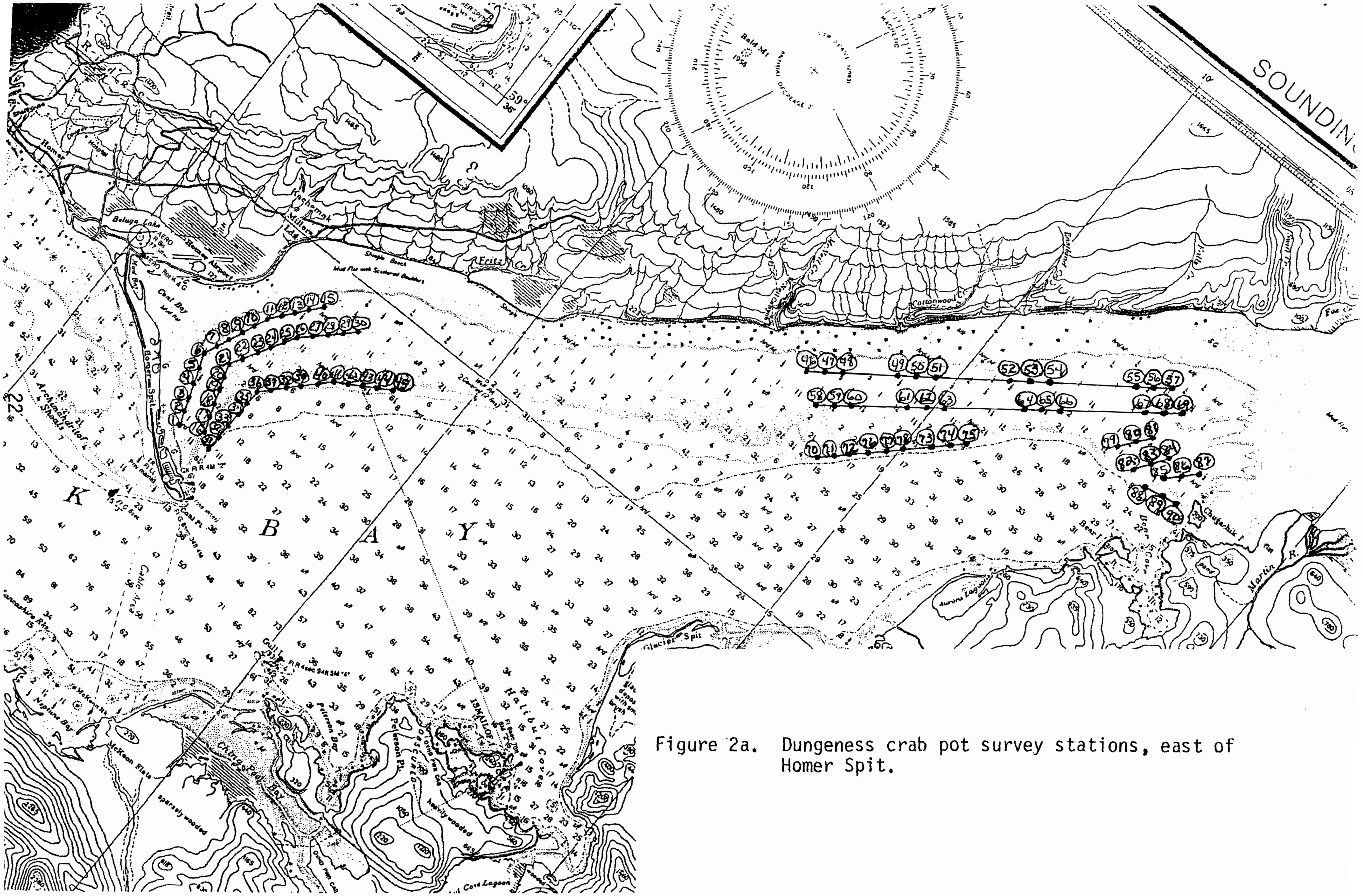

Figure 2a. Dungeness crab pot survey stations, east of Homer Spit.

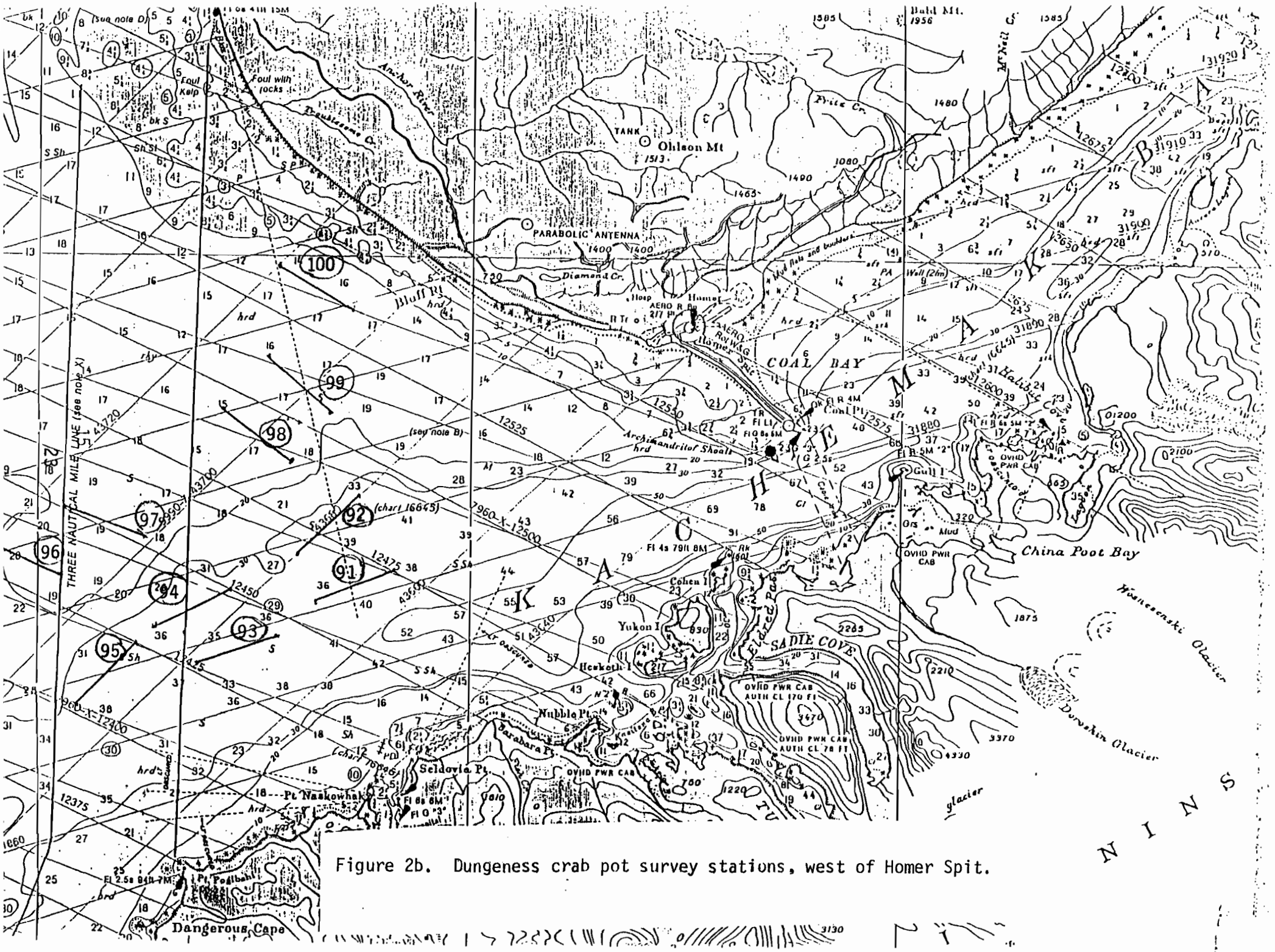

Figure 2b. Dungeness crab pot survey stations, west of Homer Spit.

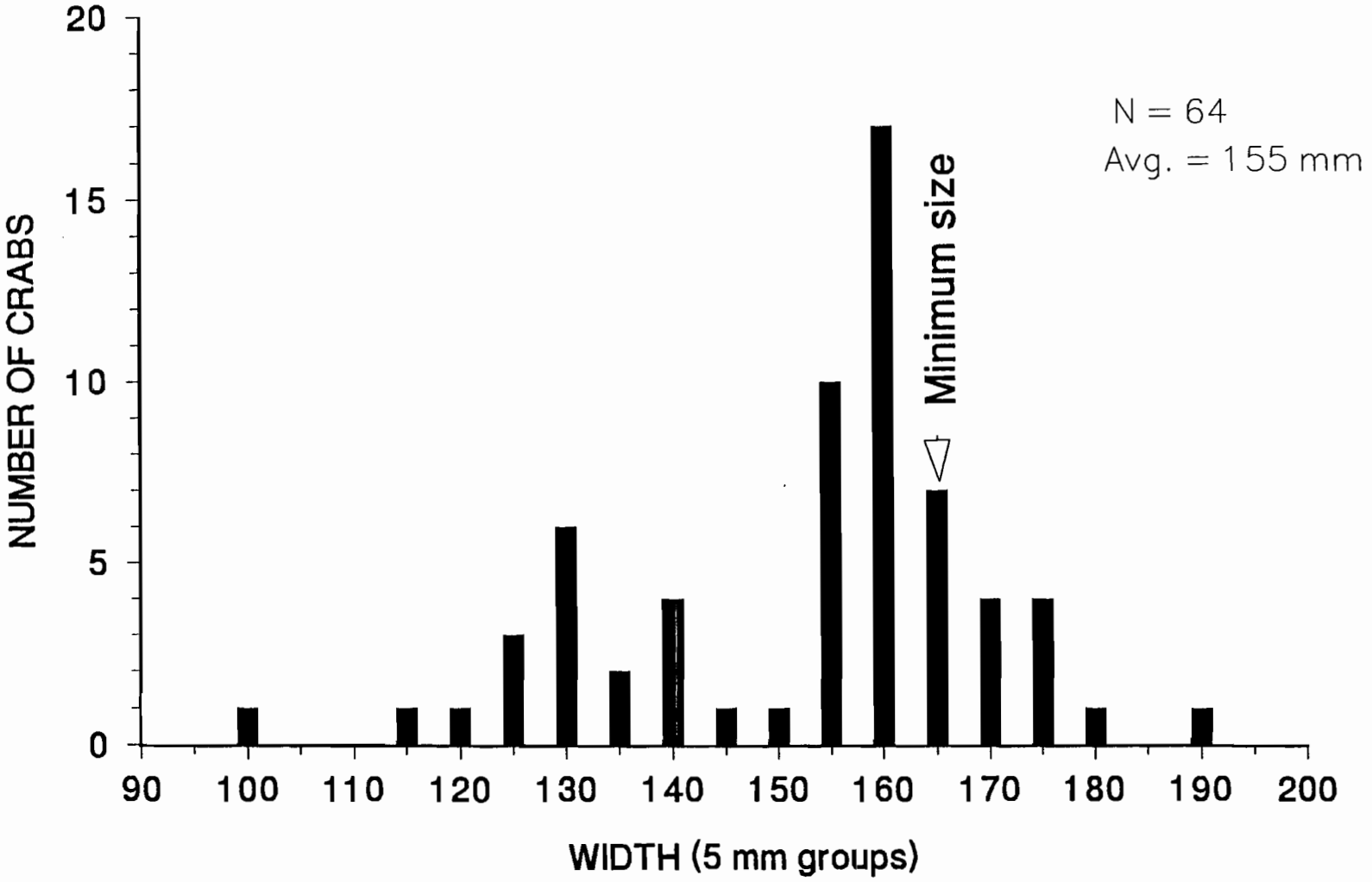

Figure 3. Male Dungeness catch, May 15 -17, 1990 Southern Distr. pot survey.

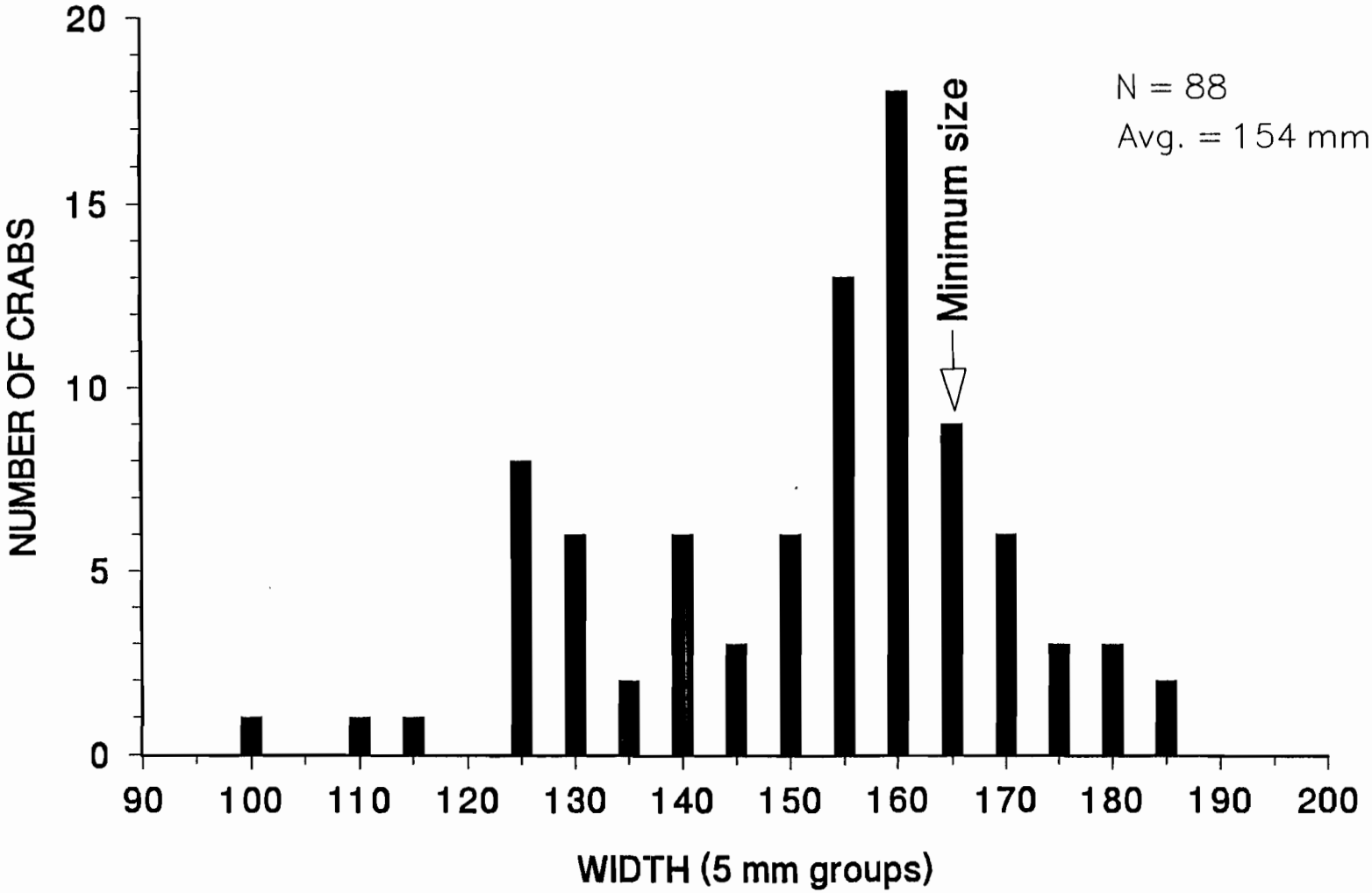

Figure 4. Male Dungeness catch, June 19 - 21, 1990 Southern Distr. pot survey.

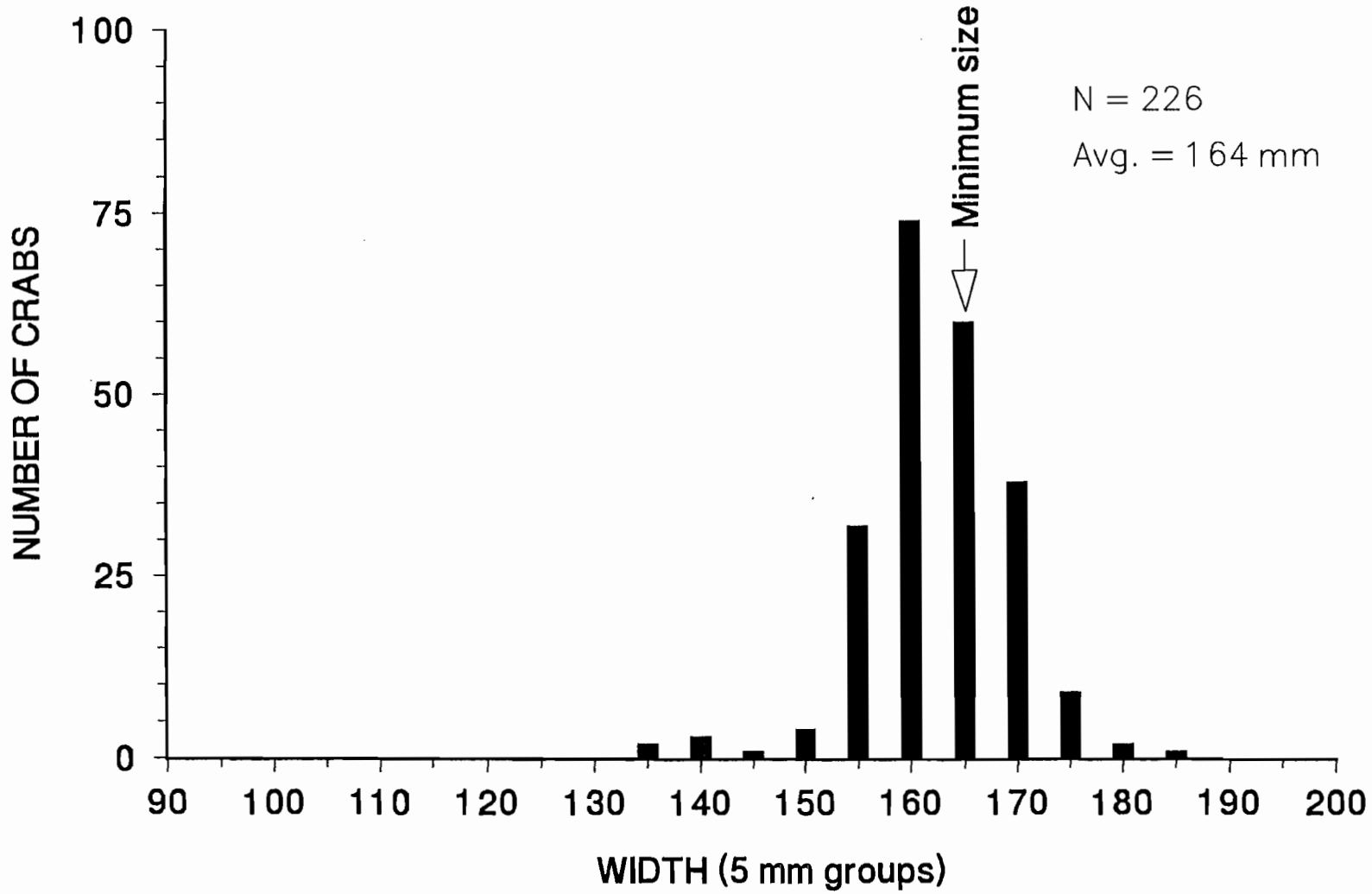

Figure 5. Male Dungeness catch, June 4 - 6, 1991 Southern Distr. pot survey.

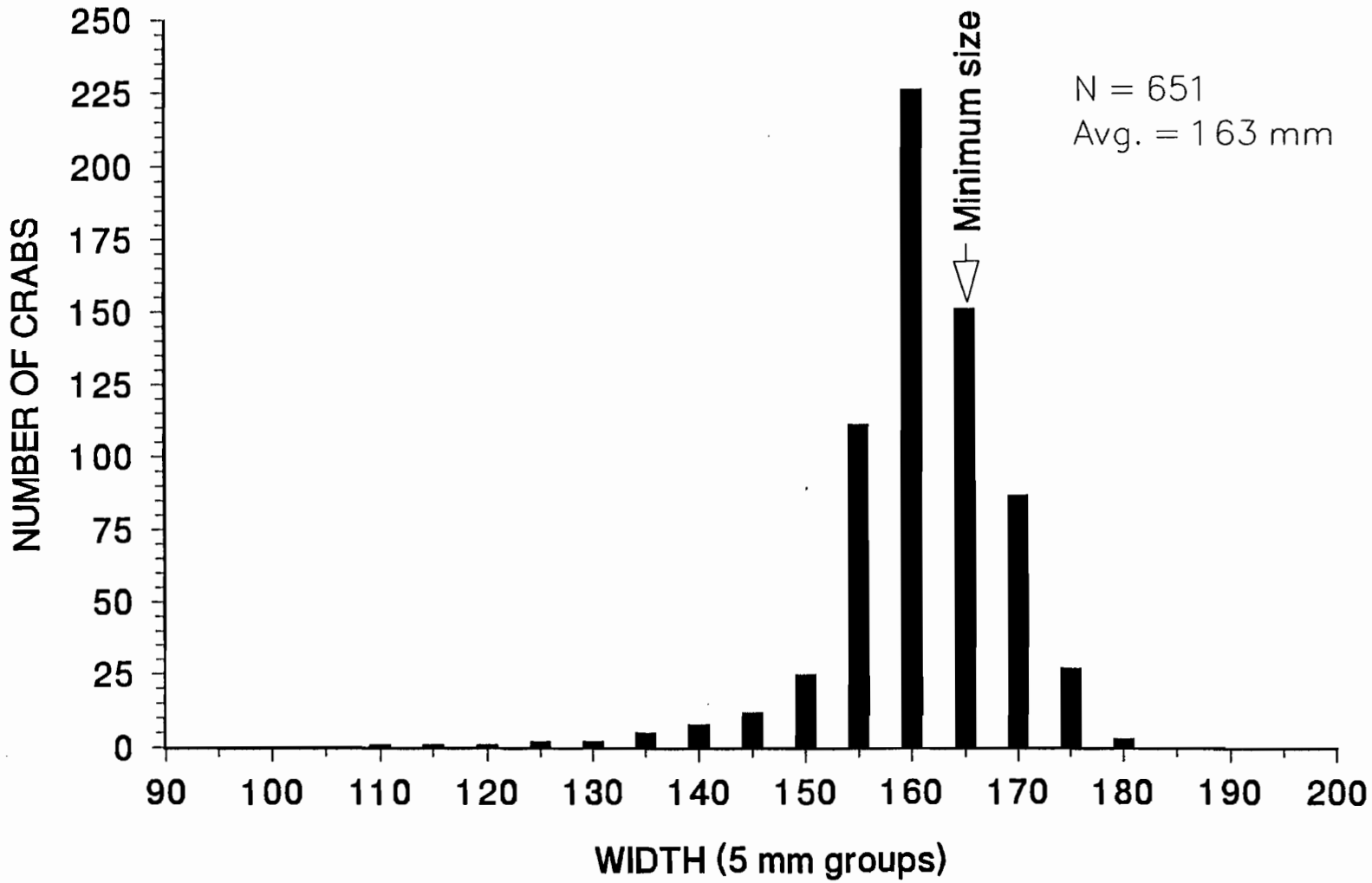

Figure 6. Male Dungeness catch, July 9 - 11, 1991 Southern Distr. pot survey.

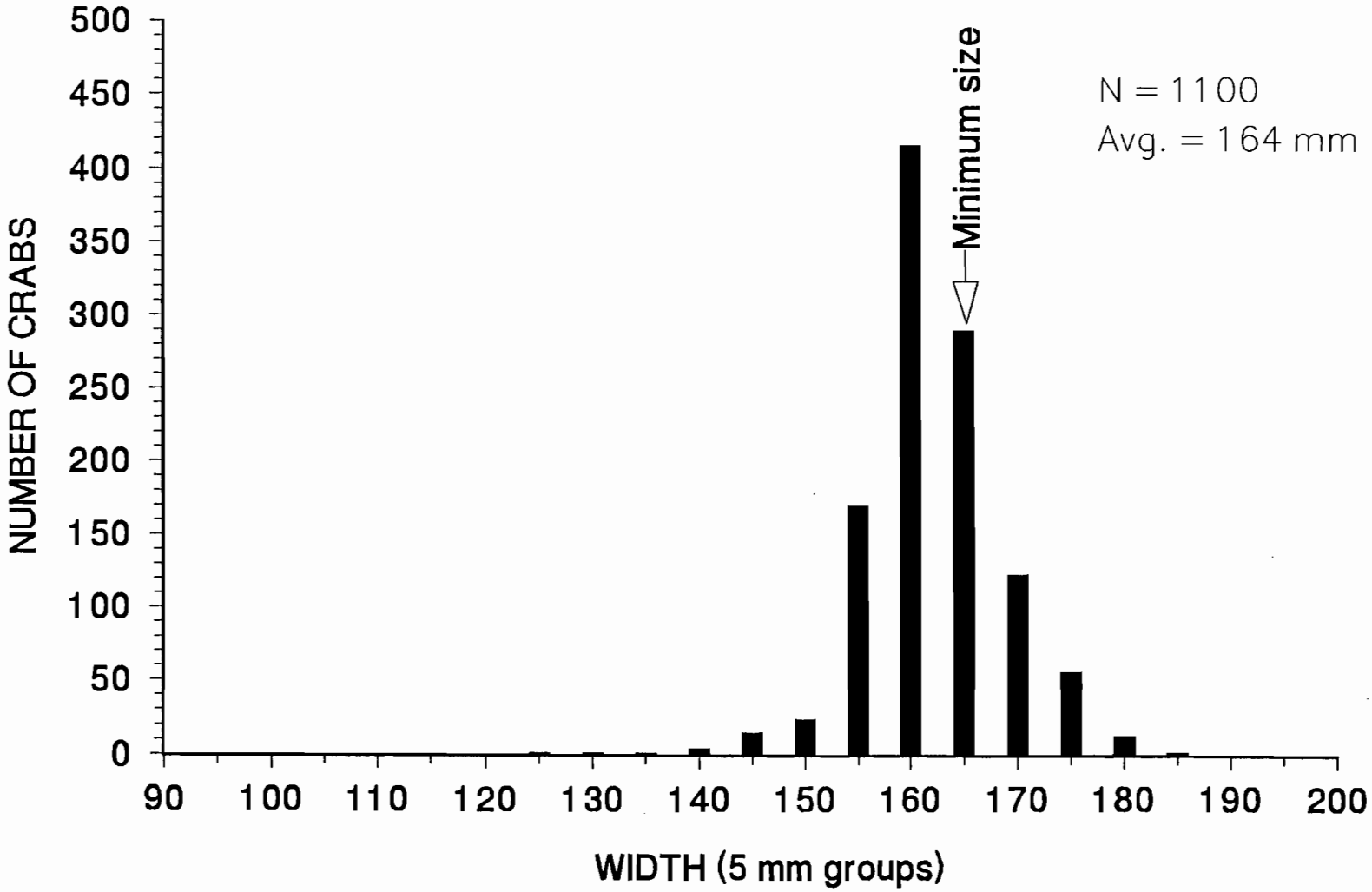

Figure 7. Male Dungeness catch, Aug. 6 - 8, 1991 Southern Distr. pot survey.

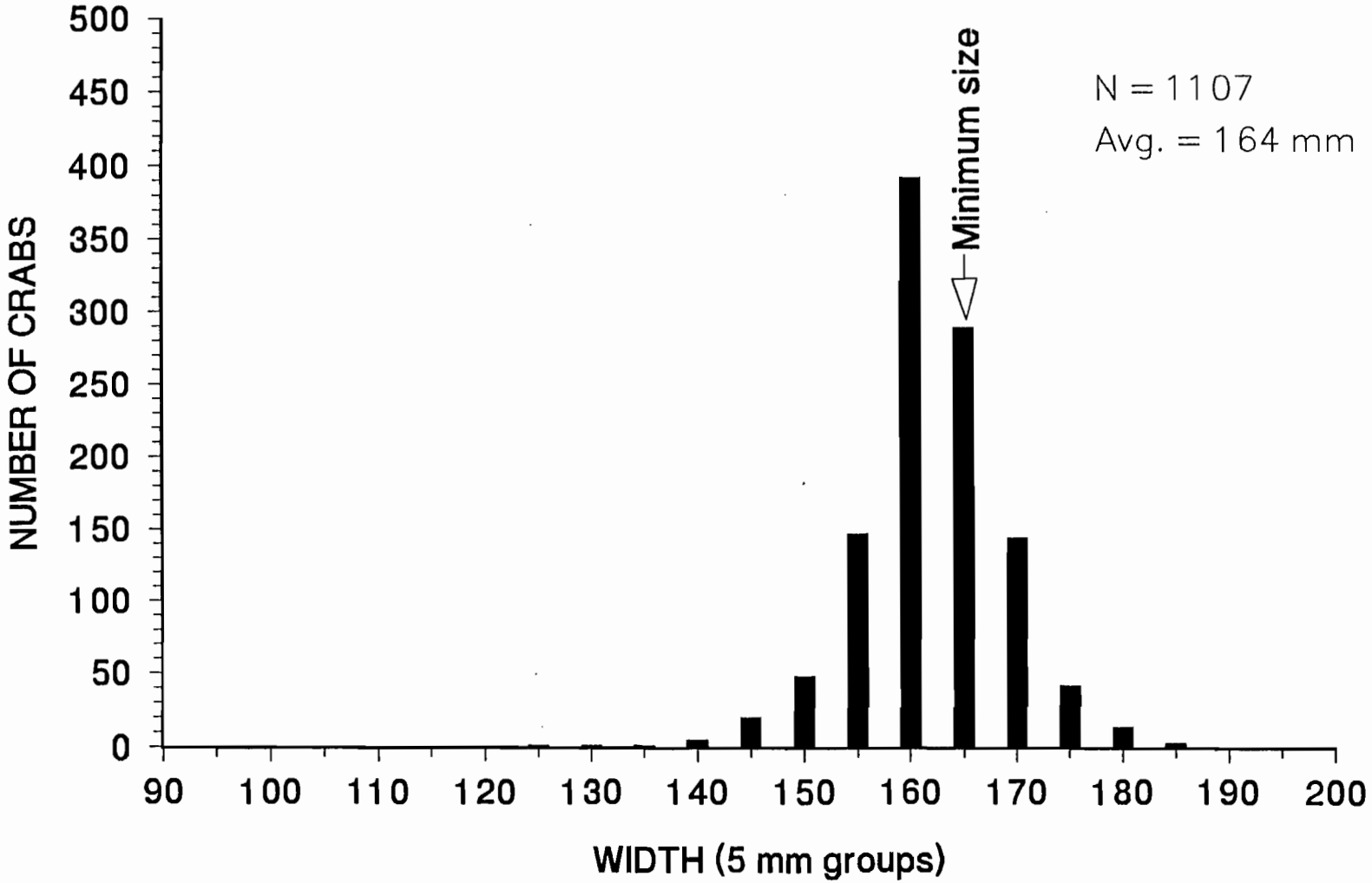

Figure 8. Male Dungeness catch, Sept. 14 - 16, 1991 Southern Distr. pot survey.

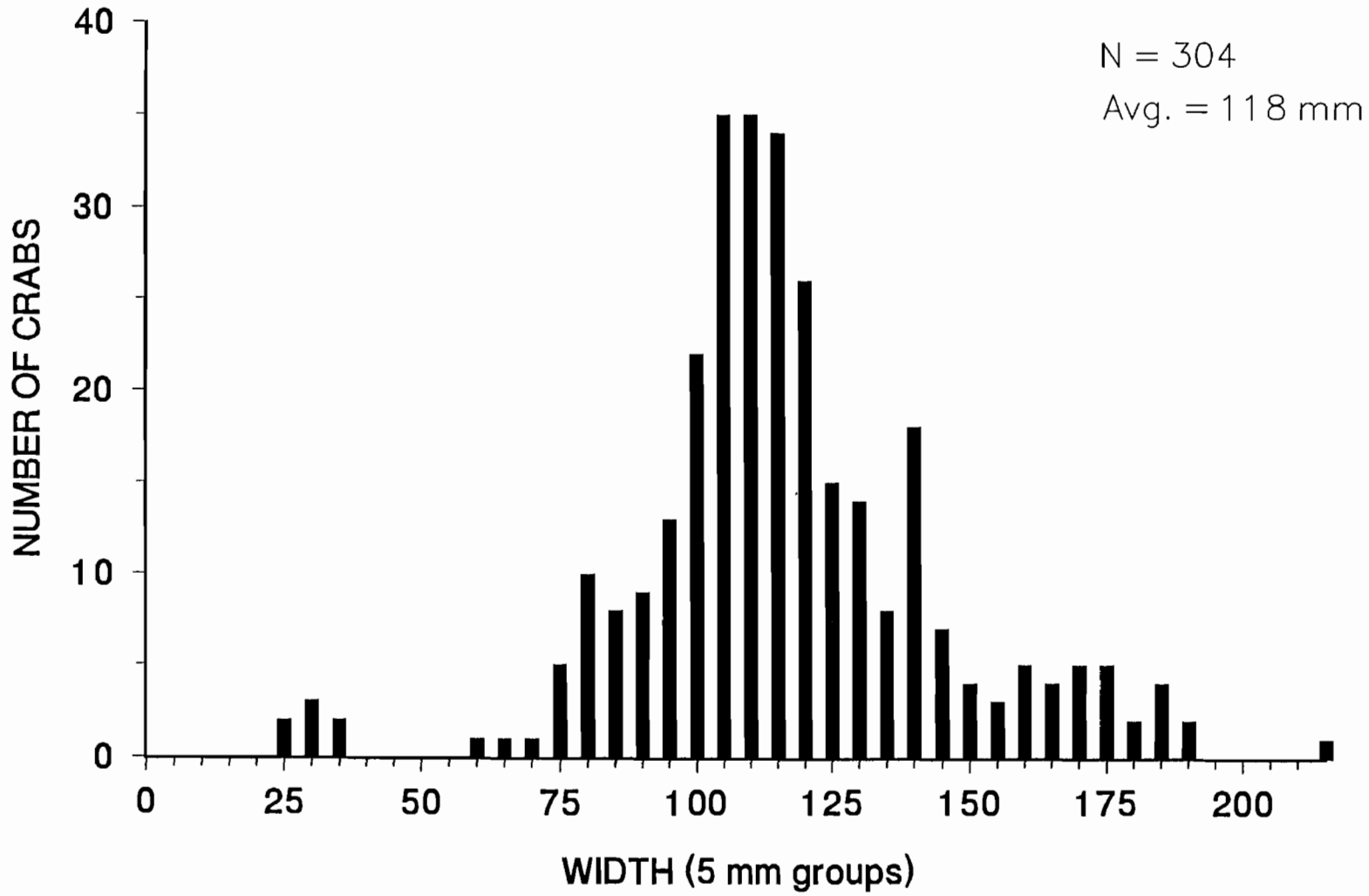

Figure 9. Male Dungeness catch, Oct., 1989 Southern Distr. trawl survey.

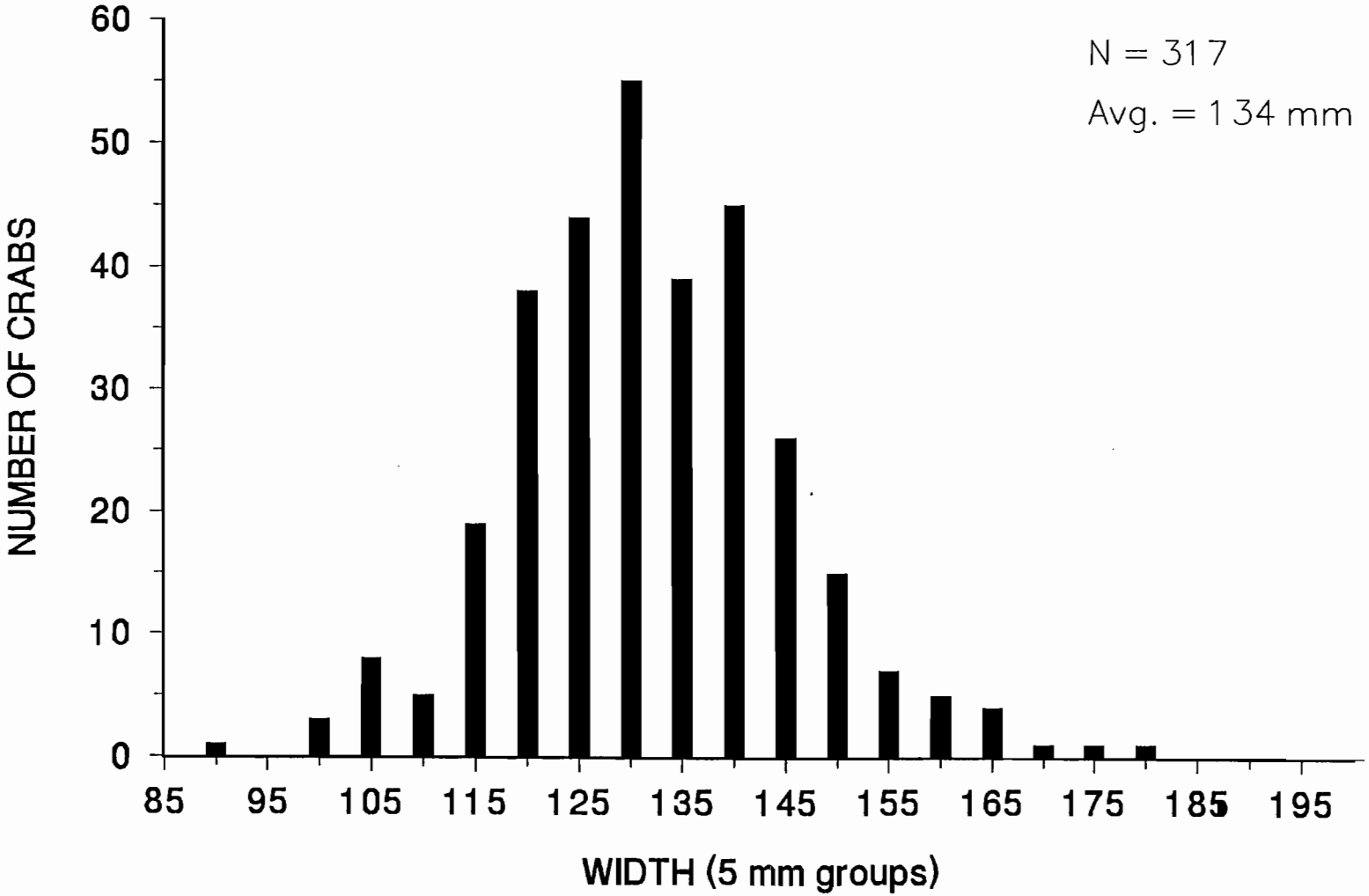

Figure 10. Male Dungeness catch, July, 1990 Southern Distr. crab trawl survey.

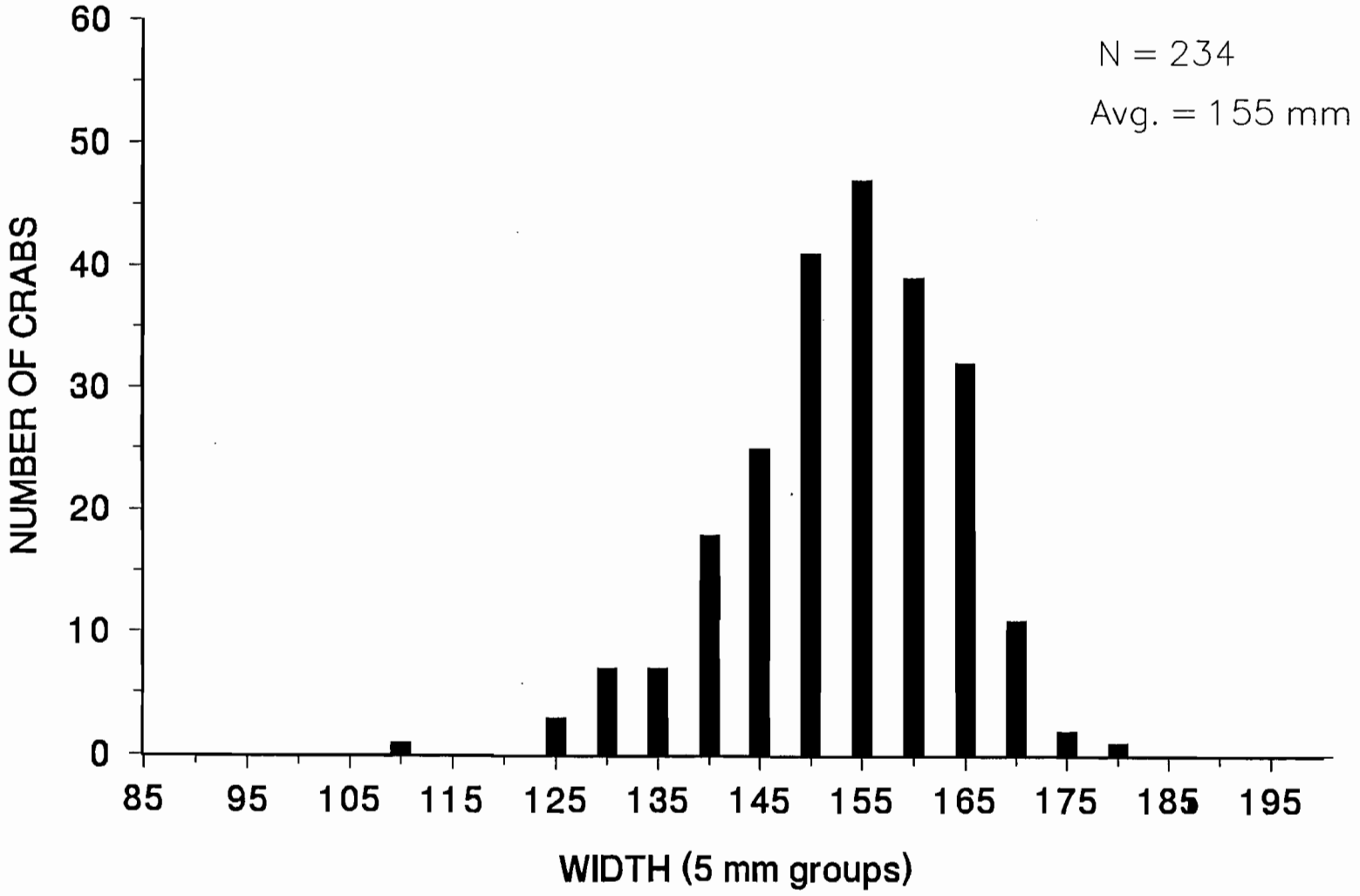

Figure 11. Male Dungeness catch, July, 1991 Southern Distr. crab trawl survey.

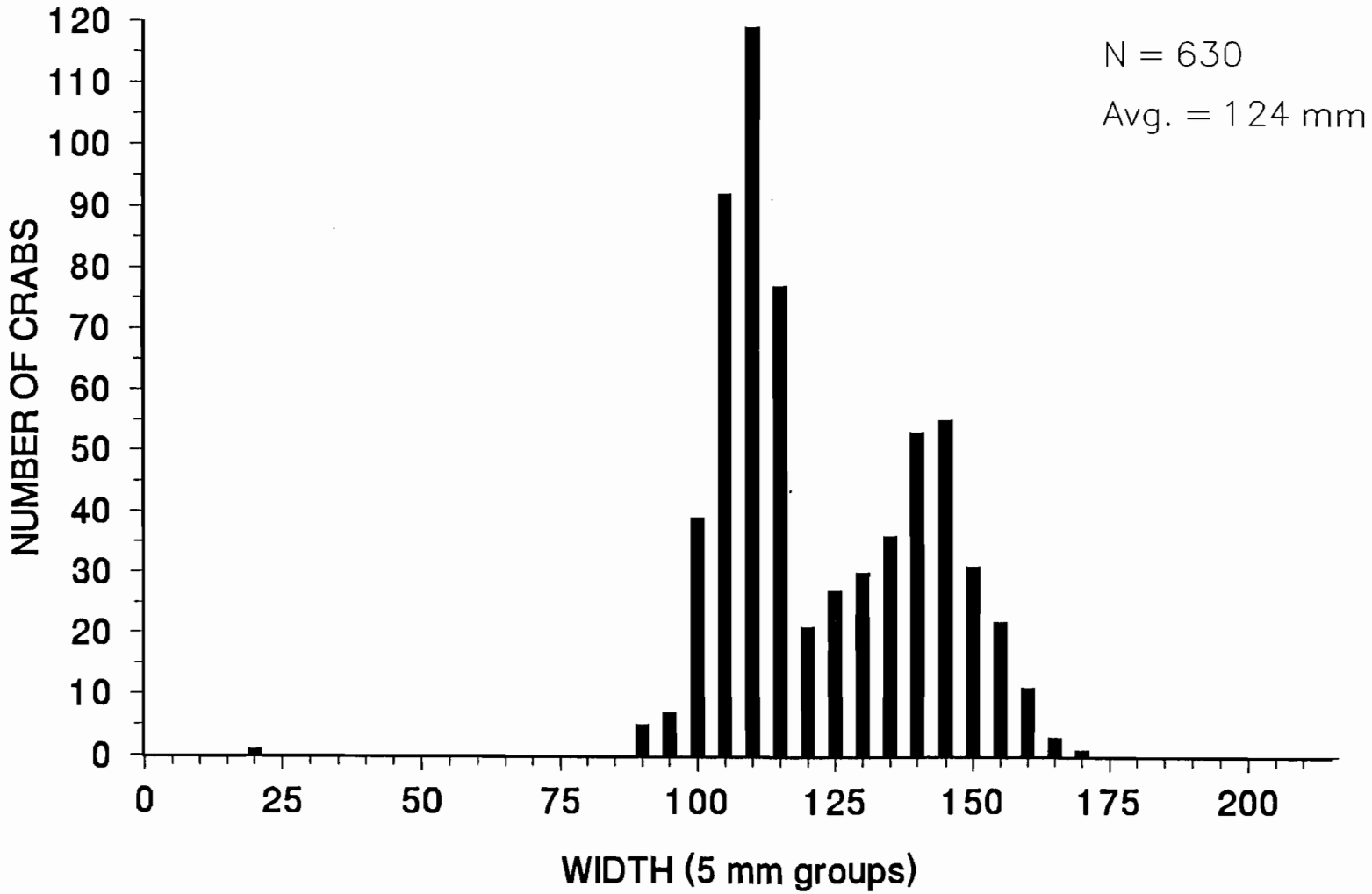

Figure 12. Female Dungeness catch, Oct., 1989 Southern Distr. trawl survey.

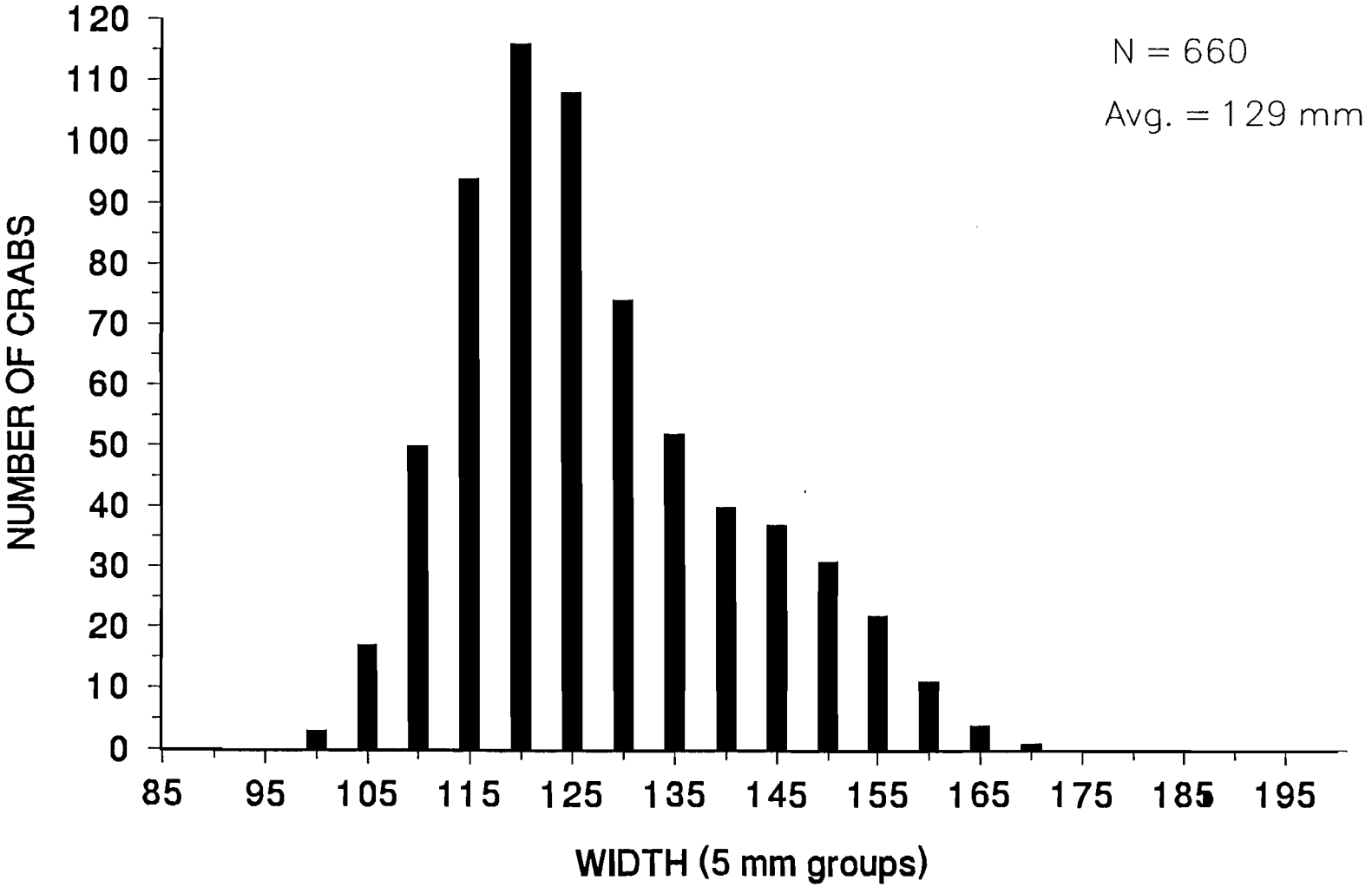

Figure 13. Female Dungeness catch, July, 1990 Southern Distr. crab trawl survey

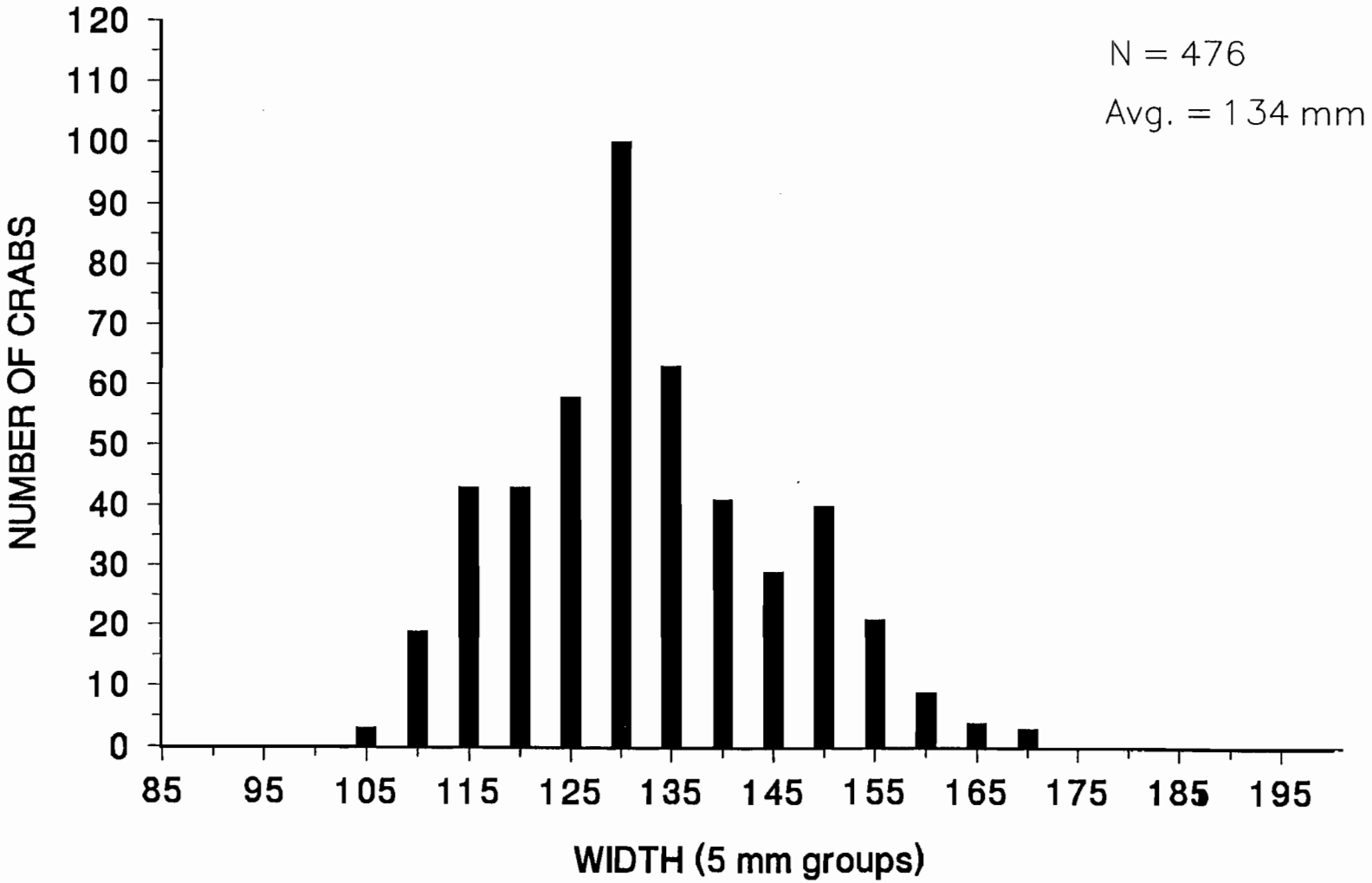

Figure 14. Female Dungeness catch, July, 1991 Southern Distr. crab trawl survey

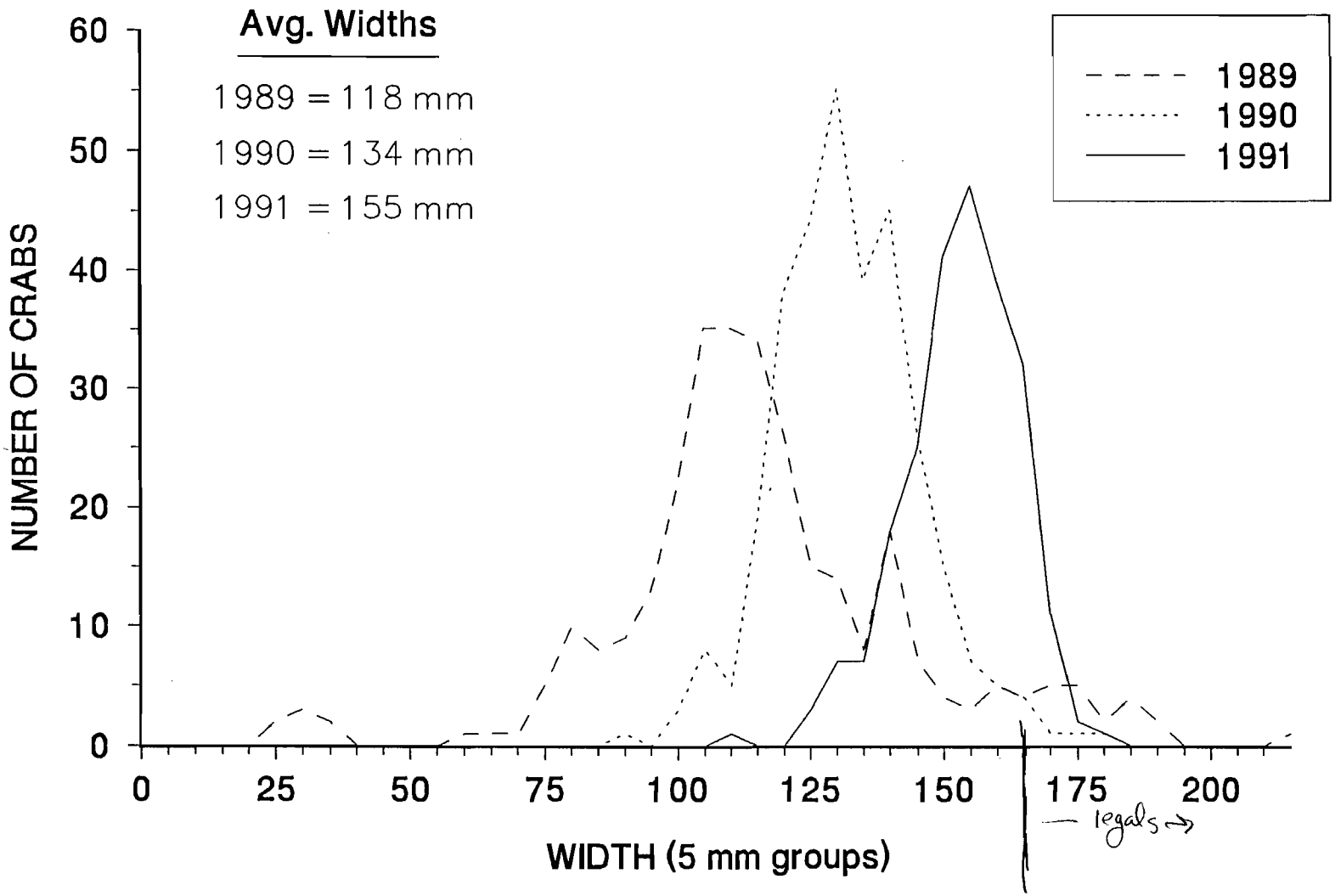

Figure 15. Male Dungeness catch, 1989 - 1991, Southern Distr. trawl surveys.

Appendix A. Survey station locations, east of Homer Spit, Southern District Dungeness pot survey, 1990-91.

Station No.	Latitude	Longitude
1.	59° 36'.90	151° 25'.90
2.	59° 37'.15	151° 26'.10
3.	59° 37'.35	151° 26'.30
4.	59° 37'.60	151° 26'.50
5.	59° 37'.82	151° 26'.65
6.	59° 38'.06	151° 26'.50
7.	59° 38'.30	151° 26'.30
8.	59° 38'.52	151° 26'.10
9.	59° 38'.80	151° 25'.90
10.	59° 38'.92	151° 25'.52
11.	59° 39'.10	151° 25'.15
12.	59° 39'.28	151° 24'.75
13.	59° 39'.45	151° 24'.40
14.	59° 39'.60	151° 24'.00
15.	59° 39'.72	151° 23'.55
16.	59° 37'.03	151° 25'.39
17.	59° 37'.30	151° 25'.50
18.	59° 37'.52	151° 25'.62
19.	59° 37'.75	151° 25'.76
20.	59° 38'.03	151° 25'.95
21.	59° 38'.25	151° 25'.63
22.	59° 38'.43	151° 25'.39
23.	59° 38'.67	151° 25'.12
24.	59° 38'.89	151° 24'.78
25.	59° 39'.03	151° 24'.40
26.	59° 39'.18	151° 23'.98
27.	59° 39'.30	151° 23'.51
28.	59° 39'.45	151° 23'.11
29.	59° 39'.60	151° 22'.70
30.	59° 39'.73	151° 22'.26
31.	59° 36'.84	151° 25'.05
32.	59° 37'.07	151° 25'.00
33.	59° 37'.31	151° 24'.91
34.	59° 37'.57	151° 24'.82
35.	59° 37'.85	151° 24'.72
36.	59° 38'.10	151° 24'.35
37.	59° 38'.28	151° 23'.95
38.	59° 38'.47	151° 23'.57
39.	59° 38'.64	151° 23'.20
40.	59° 38'.80	151° 22'.70
41.	59° 38'.92	151° 22'.30
42.	59° 39'.08	151° 21'.80
43.	59° 39'.20	151° 21'.40
44.	59° 39'.32	151° 20'.96
45.	59° 39'.46	151° 20'.50

Appendix A. Continued.

Station No.	Latitude	Longitude
46.	59° 42'.78	151° 13'.35
47.	59° 42'.95	151° 12'.90
48.	59° 43'.11	151° 12'.45
49.	59° 43'.70	151° 10'.97
50.	59° 43'.87	151° 10'.51
51.	59° 44'.05	151° 10'.10
52.	59° 44'.58	151° 08'.70
53.	59° 44'.75	151° 08'.21
54.	59° 44'.92	151° 07'.80
55.	59° 45'.50	151° 06'.30
56.	59° 45'.67	151° 05'.89
57.	59° 45'.83	151° 05'.40
58.	59° 42'.55	151° 12'.55
59.	59° 42'.71	151° 12'.11
60.	59° 42'.88	151° 11'.70
61.	59° 43'.45	151° 10'.30
62.	59° 43'.62	151° 09'.86
63.	59° 43'.08	151° 09'.40
64.	59° 44'.38	151° 08'.00
65.	59° 44'.55	151° 07'.53
66.	59° 44'.72	151° 07'.10
67.	59° 45'.28	151° 05'.65
68.	59° 45'.45	151° 05'.23
69.	59° 45'.65	151° 04'.80
70.	59° 42'.01	151° 11'.55
71.	59° 42'.23	151° 11'.18
72.	59° 42'.45	151° 10'.88
73.	59° 43'.05	151° 09'.50
74.	59° 42'.25	151° 09'.10
75.	59° 43'.48	151° 08'.70
76.	59° 42'.53	151° 10'.78
77.	59° 42'.72	151° 10'.43
78.	59° 42'.92	151° 10'.04
79.	59° 44'.80	151° 05'.67
80.	59° 45'.02	151° 05'.20
81.	59° 45'.24	151° 04'.75

Appendix A. Continued.

Station No.	Latitude	Longitude
82.	59° 44'.62	151° 05'.10
83.	59° 44'.90	151° 04'.65
84.	59° 45'.13	151° 04'.25
85.	59° 44'.75	151° 04'.30
86.	59° 45'.00	151° 03'.90
87.	59° 45'.23	151° 03'.40
88.	59° 44'.62	151° 04'.60
89.	59° 44'.67	151° 04'.01
90.	59° 44'.72	151° 03'.78

Appendix B. Survey station locations, west of Homer Spit, Southern District Dungeness pot surveys, 1991.

Station No.[1]	Begin (lat., long.)	End (lat., long.)
91	59°32.55 151°43.50	59°31.90 151°47.10
92	59°34.40 151°45.15	59°33.00 151°48.00
93	59°31.00 151°48.80	59°30.40 151°52.70
94	59°32.20 151°51.00	59°31.20 151°54.60
95	59°30.90 151°55.50	59°29.50 151°58.20
96	59°32.50 151°59.00	59°33.30 152°02.75
97	59°33.35 151°55.00	59°34.05 151°58.80
98	59°35.10 151°48.30	59°36.35 151°51.50
99	59°36.30 151°46.50	59°37.70 151°49.40
100	59°38.75 151°45.50	59°39.75 151°48.90

[1] Ten pots were set equidistant apart in each station.

Appendix C. Catch per unit of effort (cpue) of male Dungeness crabs from the Southern District Dungeness crab pot survey, 1990-91.

Year	Dates	Location	Cpue[1] Sublegal males	(range)	Legal males	(range)	Total males	(range)
1990	5/15-17	East of Spit	0.5	(0-5)	0.2	(0-2)	0.7	(0-5)
	6/19-21	East of Spit	0.7	(0-5)	0.3	(0-3)	1.0	(0-7)
1991	6/4-6	East of Spit	1.3	(0-11)	1.2	(0-13)	2.5	(0-19)
	7/9-11	East of Spit	4.3	(0-31)	2.9	(0-14)	7.2	(0-35)
	8/6-8	East of Spit	6.9	(0-23)	5.3	(0-18)	12.2	(0-38)
	9/12-14	East of Spit	6.8	(0-31)	5.5	(0-20)	12.3	(0-46)
1991	7/2-6	West of Spit	0.07	(0-3)	0.06	(0-4)	0.1	(0-6)
	8/14-16	West of Spit	0.07	(0-2)	0.1	(0-3)	0.2	(0-5)

[1] cpue - average number of crabs caught per pot.